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(58) Field of Search

Other: ONLINE EPODOC, WPI, JAPIO

(54) Abstract Title

Hands free headset apparatus for a mobile phone using an optical fibre and an acoustic pipe

(57) Headset apparatus, particularly applicable for use with a mobile phone 1 or similar equipment, is connected via signal converter 5 which converts electrical signals received via the phone 1 to an acoustic signal for transmission via sound pipe 7 to an earpiece 11 of a headset 10. The headset 10 comprises an optical microphone 12 which modulates a light signal received on optical fibre 8 from a light source 14. The modulated light signal is returned to opto-electronic converter 17 which converter 17 generates an electrical signal conveying any acoustic signal received by the microphone 12 to mobile radio 1.

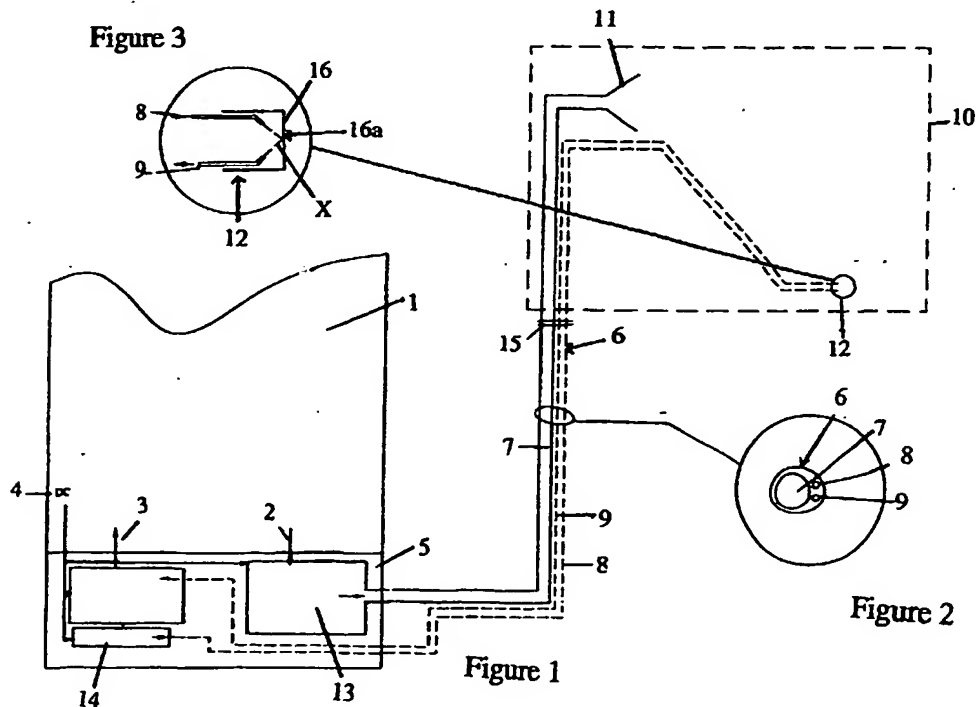


Figure 3

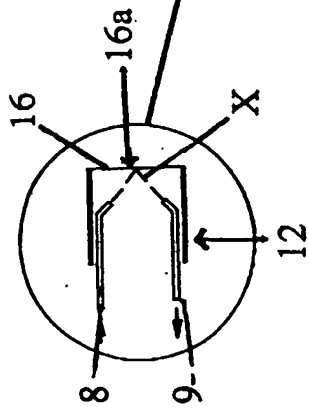


Figure 1

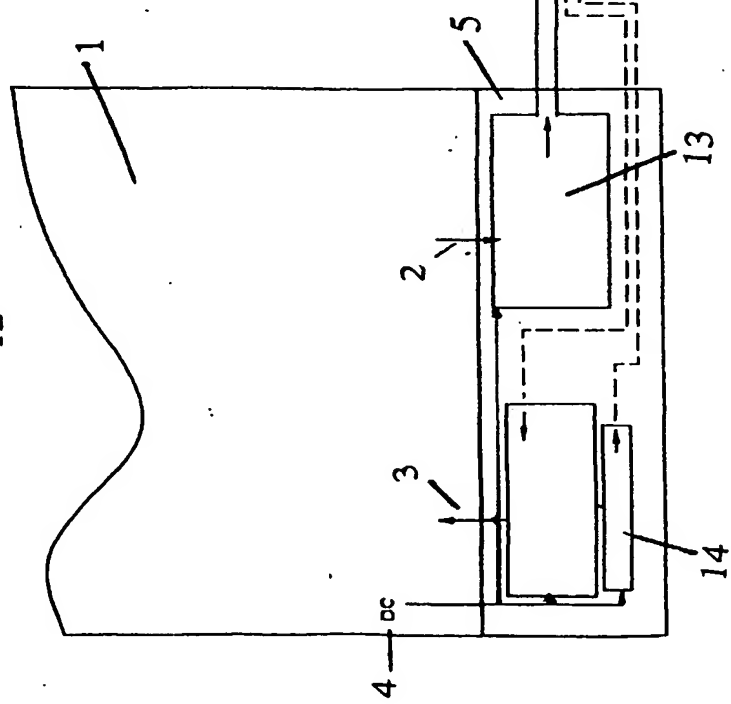
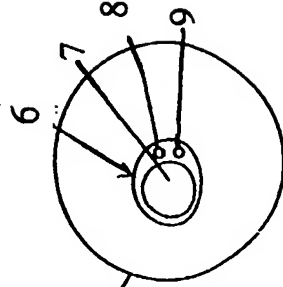


Figure 2



HEADSET APPARATUS

The present invention relates to headset apparatus and is particularly, although not exclusively, applicable to headset apparatus for use with a radio where radiation from a radio transmitter is a hazard, or a perceived hazard, to the user. The invention finds particular application to mobile phones.

5

Exposure to high level electromagnetic radiation is potentially a health hazard and concerns at present centre on electromagnetic radiation from overhead power lines with electromagnetic fields that are very high, and electromagnetic radiation from mobile phones where, although the field is considerably weaker, the antenna is in close proximity
10 to the user brain of the user, which it is perceived may be detrimental.

To reduce the risk of radiation when using a mobile phone remote headset kits are available which employ an additional speaker and microphone, the speaker plugging into the ear of the user with the microphone dangling from the lead to the speaker in close
15 proximity to the mouth of the user. The combined electrical lead from both extends to a socket which is standard on most mobile phones for receiving an input from an external microphone and outputting a signal to an external speaker.

Various alternative arrangements of external speakers and microphones exist, for example
20 the speaker and microphone may be built into a motorcycle helmet or similar, or two speakers may be located on a headband such that speakers correspond to the position of the

ears of the user, with a microphone possibly located on a boom extending from one of the earpieces.

In the context of the present specification, regardless of the configuration and mounting arrangement, the term "headset" is defined as any earpiece and microphone combination
5 whereby in use the earpiece is intended to be located in a users ear, or is in close proximity to a users ear, and the microphone is arranged to be located sufficiently close to the users mouth to enable it to perform its function and to be supported in some manner from the head of the wearer, thus including all the above referred to and other configurations.

10

Although by employing headsets remote from the antenna of a mobile phone, the source of radiation is located remote from the head of the user, the electrical conductors conveying the signals to and from the headset are connected to the mobile phone and will most likely convey some radiation to the user as a result. Furthermore, because of the small size of a
15 mobile phone the headset lead is likely to be in close proximity to the antenna of that phone and in use may occasionally be directly next to the antenna of the phone. The lead will then pick up the electromagnetic radiation and effectively extend that source of electromagnetic radiation to the user. This problem is not confined to mobile telephones, similar situations arising with other radios, for example field radios, where the user would
20 normally wear a headset connected to the radio. In addition there is now also some concerns relating to non-radio equipment where although the radiation hazard is less, there is still a perceived hazard with wearing a headset for prolonged periods of time. For example, this may occur with call centre operatives and the like.

According to the present invention there is provided a headset apparatus comprising a headset having a microphone and at least one earpiece, the apparatus being characterised in that the microphone is an optical microphone arranged such that incident acoustic waves modify an optical signal and in that the at least one earpiece comprises a sound pipe having
5 a first end arranged to cause acoustic waves within the sound pipe to be transmitted to the ear of a user of the headset and a second end arranged to be connected to a sound tube.

Employing the present invention provides a headset, (as previously defined) which headset does not require any electrical conductor. Therefore the headset is in electrical isolation
10 from any electrical apparatus particularly, any transmitter.

The present invention arose from the realisation that there might be a problem with conventional headset arrangement employing electrical conductors which can convey electromagnetic radiation from a transmitter. The inventor was aware that sound pipes are
15 known to convey sound to a headset, for example in hospitals where a radio is often mounted in the wall with the patient lying in bed wearing an earpiece attached to a sound pipe extending to the radio. The inventor applied this principle to the problem of conveying sound to an earpiece, but found that when one tries to reverse this principle and attach a sound pipe to a microphone, attenuation in the sound pipe is so great that the
20 output from a receiver at the receiving end of the sound pipe has to be amplified to such an extent that the signal to noise ratio is so great as to make the system unworkable.

To solve this problem the inventor has employed an optical microphone which is sometimes used in surveillance work. Its advantage in such work is that a hidden

microphone can be employed having a connection to the microphone which consists only of one or more optical fibres. Such optical fibre is both very fine, such that it may be for example placed behind wallpaper, and is also non-metallic, non-electrically conductive and therefore difficult to detect. It is this absence of any electrical conductor which makes it
5 applicable to the problem faced by the inventor.

An example of optical microphones which may be employed with the present invention are disclosed in European Patent Applications EP 0716291, EP 077404 and EP 0866313, the applicant of which is Phone-Or Limited of Israel, these patent applications being herein
10 incorporated by way of reference.

Preferably, the present invention further comprises a signal converter that can be arranged remotely of said headset; at least one optical fibre; and a sound tube, wherein the signal converter is arranged to;

- 15 a) receive an electrical or electromagnetic signal conveying an acoustic signal and convert that signal to an acoustic wave signal, the signal converter, sound tube and at least one earpiece being connected together such that the acoustic wave signal generated in the signal converter is conveyed to the user via the sound tube and at least one earpiece;
- b) to generate an optical signal, the signal converter, one optical fibre and the
20 microphone being connected together such that the generated optical signal is transmitted to the microphone, the microphone being arranged such that any acoustic signal received by the microphone will cause the optical signal to be modified, the microphone, the one optical fibre and the remote signal converter being connected together such that the modified optical signal is conveyed via the one optical fibre to the signal converter; and

c) to convert the modified optical signal into an electrical or electromagnetic signal for conveying any acoustic signal received at the microphone.

The optical microphones, such as those disclosed in the above referenced applications
5 modify an optical signal received by an optical fibre and that modified signal can be transmitted along another optical fibre, or possible down the same optical fibre, to the remote signal converter, thereby establishing a connection between the remote signal converter and the microphone without the need for any electrical conductors. This in combination with the sound tube enables two-way communication with a user without any
10 requirement for electrical conductors.

Preferably the earpiece has associated with it a connector for both the acoustic tube and at least one optical fibre, wherein the or each optical fibre comprises two sections, a first section extending from the microphone to the connector and a second section from the
15 connector to the remote signal converter. Preferably the sound tube and at least a section of the at least one optical fibre terminate in a second portion of the connector arranged to connect with the first portion. This enables a single connector to connect both the sound tube and the at least one optical fibre.

20 Preferably the sound tube is formed of a flexible material with one or more optical fibres integrally moulded within the sound tube, or embedded in the wall of the sound tube such that they are effectively integrally moulded within the sound tube, for this provides protection to the optical fibres and also then only requires a single connection lead between the remote signal converter and the headset.

The present invention is particularly advantageous when the signal converter remote from the headset comprises a radio transmitter, ensuring that the signal from the radio transmitter cannot be coupled to the user via way of the headset, and the invention finds
5 particular application with the headset of a hands-free kit of a mobile phone. The signal converter may be within the mobile phone itself or alternatively may be an adapter for a mobile phone such that the adapter can be sold separately to the mobile phone.

In addition to applications to mobile phones, the apparatus of the invention is equally
10 applicable to a field radio where radiation coupling via the headset could also be a potential hazard.

According to a second aspect of the invention, there is provided a connection lead comprising a flexible sound tube having a sound pipe for conveying acoustic signals and at
15 least one optical fibre integrally moulded therein.

One embodiment of the present invention will now be described, by way of example only, with reference to the accompanying Figures of which:

20 Figure 1 schematically illustrates components of the present invention;

Figure 2 is a cross-section through the sound tube shown schematically in Figure 1; and

Figure 3 illustrates the principle components of the optical microphone of Figure 1.

Referring first to Figure 1, a mobile phone 1 has an integral aerial, not shown, for transmitting and receiving radio signals conveying communications to and from a user.

The mobile radio 1, which could equally be a field radio, any other radio having an
5 antenna, or indeed any other electrical apparatus which it is desired to completely electrically isolate from a user, comprises an electrical audio output 2 and electrical audio input 3 for signals transmitted and to be received respectively. The mobile radio 1 also has a dc terminal 4.

10 Attached to the base of the mobile radio 1 is an adapter 5, or signal converter. The adapter 5 is connected to the audio output 2, to the input 3, to dc output 4 and to sound tube 6. The sound tube 6, as seen more clearly in the cross-section thereof shown in the Figure 2, comprises a sound pipe 7 and two optical fibres 8 and 9. The sound tube 6 extends
15 between the adapter 5 and the headset 10, which is represented by the square shown in broken line.

The headset 10, may be of any known type or any form, typically comprising a headband securing one or two earpieces in place with a boom microphone attached thereto.

Alternatively it may simply be an earpiece worn by the user with a microphone attached at
20 a distance from the earpiece, such that it is supported in sufficiently close proximity to the user's mouth when the earpiece is installed in the ear. In another alternative, the headset may comprise an earpiece and microphone implanted in a helmet, the invention being appropriate to any such application.

The sound pipe 7 of the sound tube 6 attaches to a earpiece 11 through which the sound pipe continues to the users ear, or very proximate thereto and the optical fibre 8, extends to the microphone 12, shown in more detail in Figure 3. In operation any audio signal 2 output from the mobile phone 1, is converted from an electrical signal to an acoustic signal by acoustic converter 13. This generates an acoustic signal in sound pipe 7 which is transmitted to earpiece 11 and thus to the user so that the user can hear the intended acoustic signal received by the phone without the requirement of any electrical conductor passing to the headset 10.

The adapter 5 also comprises a coherent light source 14 which generates a coherent light signal along an optical fibre 8. This optical fibre 8 terminates in the microphone 12 and the signal is incident on metallised reflective membrane 16 from which it is reflected to optical fibre 9. Any acoustic signal 16a, incident on membrane 16, generated by the user speaking, causes the path length X to vary and thus the light signal to be modified. This signal is received by opto-electronic converter 17 of the adapter 5 which compares it with the transmitted signal and uses any phase modulation occurring as a result of the acoustic signal 16a, incident on the membrane 16 of the microphone 12, to generate an electrical signal to the input 3 of the mobile phone 1, conveying the acoustic data received by the microphone 12. A connector 15, may be employed by which the headset is connected to the sound tube 6

The optical microphone 12, may be any suitable optical microphone such as those disclosed in European Patents EP 0716291, EP 077404 or EP 0866313.

As already mentioned the invention may have any number of applications and therefore is not intended to be limited to the embodiment illustrated. Various modifications and variations will occur to one skilled in the art, which modifications and variations will be within the scope of the appended claims. In particular the invention is not limited to a

5 mobile phone application, this being given by way of example only, or to any particular arrangement of earpiece and microphone in a headset. Similarly, the embodiment illustrated employs two optical fibres but it may be possible to employ an embodiment using a single fibre for both the source signal and the modified return signal to the microphone.

CLAIMS

1. Headset apparatus comprising a headset having a microphone and at least one earpiece, the apparatus being characterised in that the microphone is an optical microphone arranged such that incident acoustic waves modify an optical signal and in that the at least one earpiece comprises a sound pipe having a first end arranged to cause acoustic waves within the sound pipe to be transmitted to the ear of a user of the headset and a second end arranged to be connected to a sound tube.
2. Apparatus as claimed in Claim 1 characterised in further comprising a signal converter that can be arranged remotely of said headset, at least one optical fibre and a sound tube, wherein the signal converter is arranged to:
 - a) receive an electrical or electromagnetic signal conveying an acoustic signal and convert that signal to an acoustic wave signal, the signal converter, sound tube and at least one earpiece being connected together such that the acoustic wave signal generated in the signal converter is transmitted to the user via the sound tube and the at least one earpiece;
 - b) to generate an optical signal, the signal converter, one optical fibre and the microphone being connected together such that the generated optical signal is transmitted to the microphone, the microphone being arranged such that any acoustic signal received by the microphone causes the optical signal to be modified, the microphone, the one optical fibre and the remote signal converter being connected together such that the modified optical signal is conveyed via the one optical fibre to the signal converter; and

- c) to convert the modified optical signal into an electrical or electromagnetic signal for conveying any acoustic signal received at the microphone.
3. Apparatus as claimed in Claim 2 comprising two optical fibres, one arranged to convey the optical signal from the signal converter to the microphone and one arranged to convey the modified signal from the microphone to the signal converter.
4. Apparatus as claimed in claim 2 or 3 wherein the optical signal generated by the signal converter and the optical signal modified by the microphone are conveyed by the same optical fibre.
5. Apparatus as claimed in any one of claims 2 to 4 wherein the earpiece has associated with it a connector for both the acoustic tube and at least one optical fibre, and wherein the or each optical fibre comprises two sections, a first section extending from the microphone to the connector and a second section from the connector to the remote signal converter.
6. Apparatus as claimed in any one of claims 2 to 5 wherein the headset further comprises a first portion of a connector for receiving both the sound tube and a first section of the at least one optical fibre, wherein the sound tube and a second section of the at least one optical fibre terminate in a second portion of the connector arranged to connect with the first portion.

7. Apparatus as claimed in any one of claims 2 to 4 wherein the sound tube is formed of a flexible material and wherein the at least one optical fibre is, or is effectively, integrally moulded within the sound tube.
8. Apparatus as claimed in any one of claims 2 to 7, wherein there is no electrically conductive link between the headset and the signal converter remote from said headset.
9. Apparatus as claimed in any one of claims 2 to 8, wherein the signal converter remote from said headset comprises a radio transmitter.
10. Apparatus as claimed in any one of claims 2 to 9 wherein the headset is part of a "hands-free" kit of a mobile phone.
11. Apparatus as claimed in any one of claims 2 to 10 wherein the signal converter is a mobile phone.
12. Apparatus as claimed in any one of claims 2 to 8, wherein the signal converter is an adapter for a mobile phone.
13. A field radio comprising the apparatus of Claim 9.

14. Headset apparatus substantially as hereinbefore described with reference to, and/or as illustrated in, one or more of the accompanying figures.
15. A mobile radio adaptor substantially as hereinbefore described with reference to, and/or as illustrated in, one or more of the accompanying figures.
16. A connection lead comprising a flexible sound tube having a sound pipe for conveying acoustic signals and at least one optical fibre integrally moulded therein.



INVESTOR IN PEOPLE

Application No: GB 0114773.5
Claims searched: All

Examiner: Paul Marshall
Date of search: 11 February 2002

Patents Act 1977 Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.T):

Int Cl (Ed.7):

Other: Online: EPODOC, WPI, JAPIO

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
X	GB 2362287 A (ROKE MANOR RESEARCH LIMITED) See figure 1 and text.	1, 2, 4, 7-12, 16
X	WO 01/78442 A2 (MAYER & DECHOVICH) See text.	1-4, 7-12, 16

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